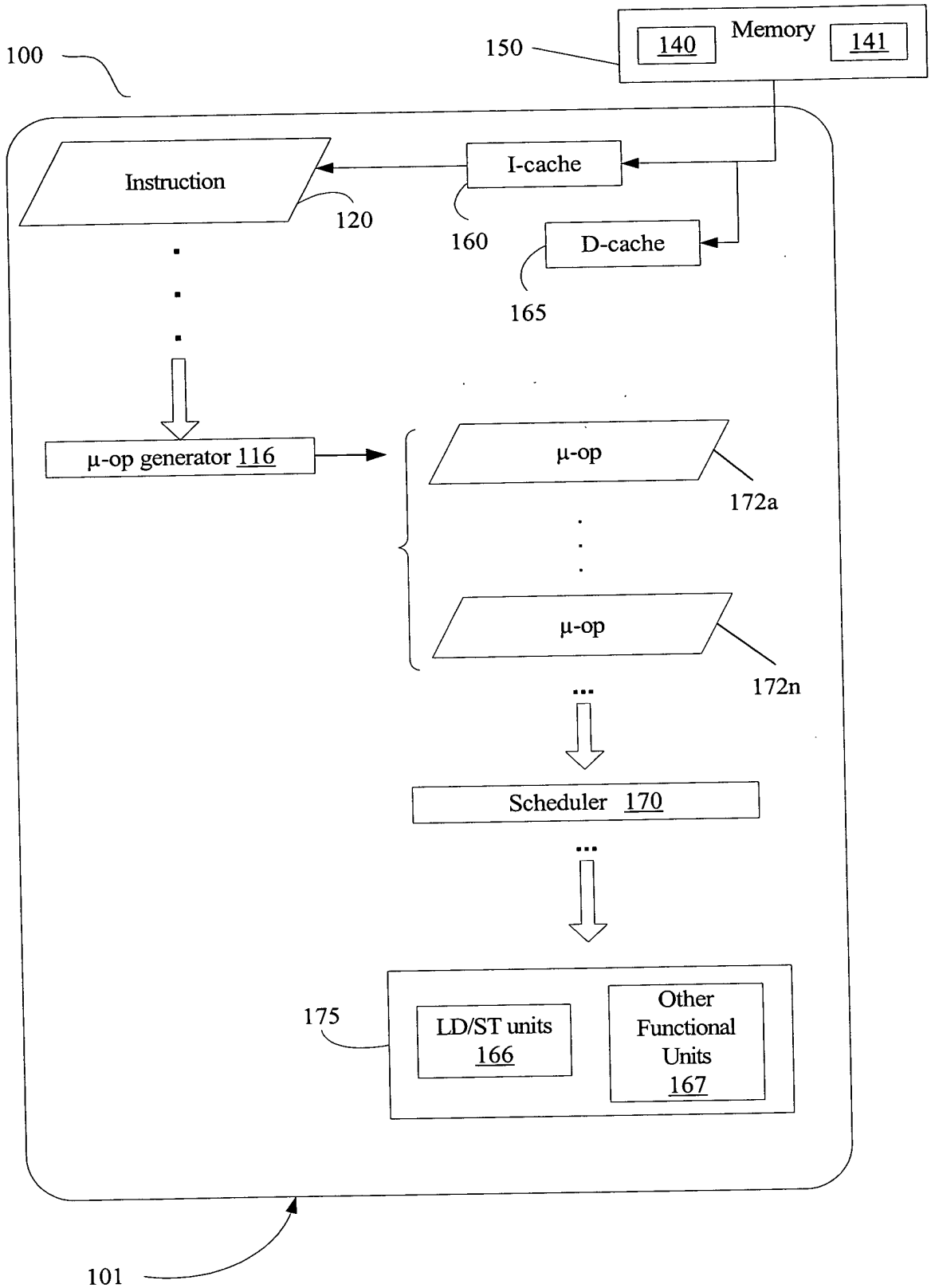

100
150
Memory
140
141
Instruction
120
I-cache
160
D-cache
165
µ-op generator 116
µ-op
172a
µ-op
172n
Scheduler 170
175
LD/ST units
166
Other
Functional
Units
167
101

Fig. 1

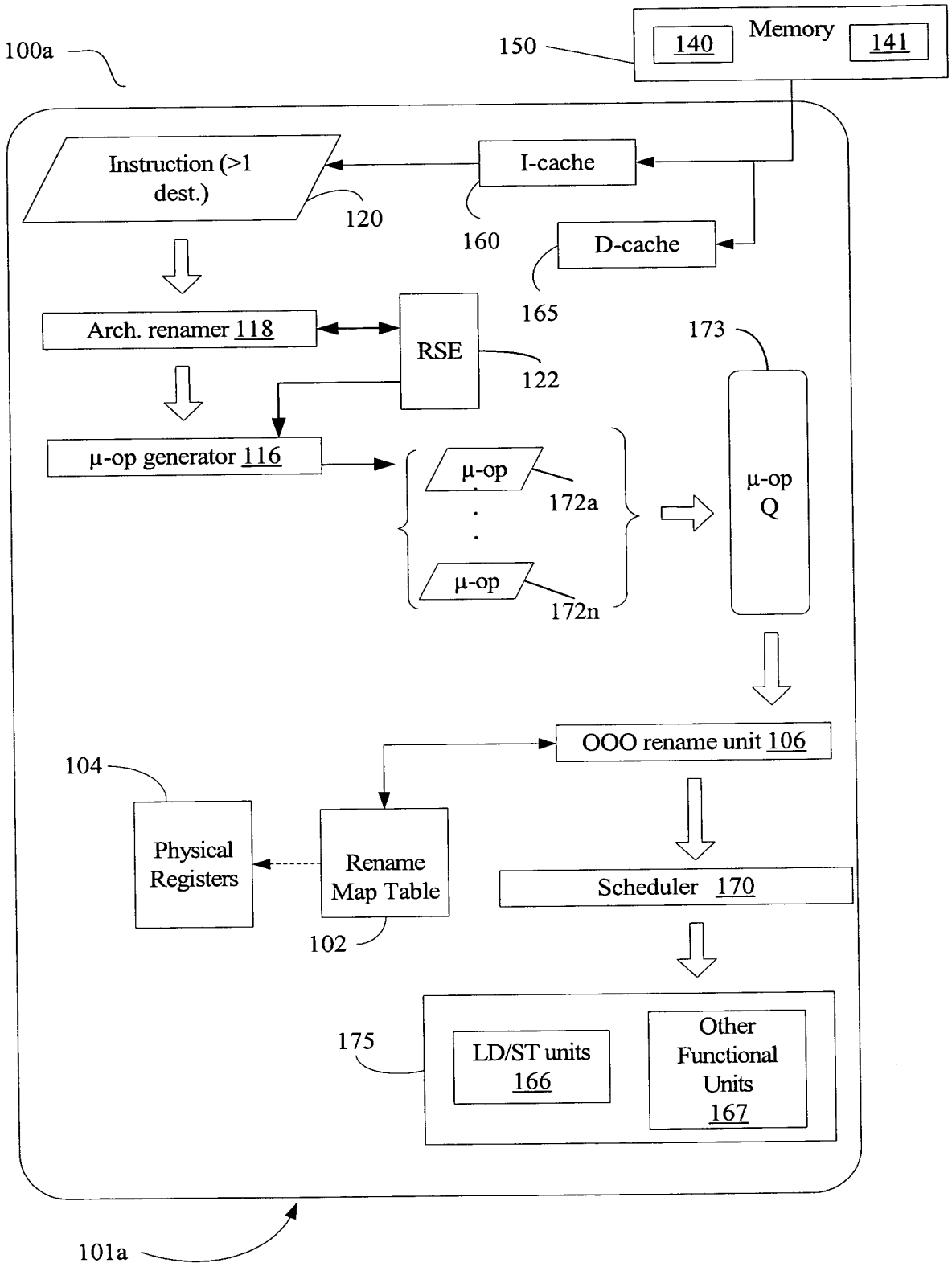

100a
150
Memory
140
141
Instruction (>1 dest.)
120
I-cache
160
D-cache
165
Arch. renamer 118
RSE
122
173
μ-op generator 116
μ-op
172a
μ-op
172n
μ-op Q
OOO rename unit 106
104
Physical Registers
Rename Map Table
102
Scheduler 170
175
LD/ST units 166
Other Functional Units 167
101a

Fig. 2

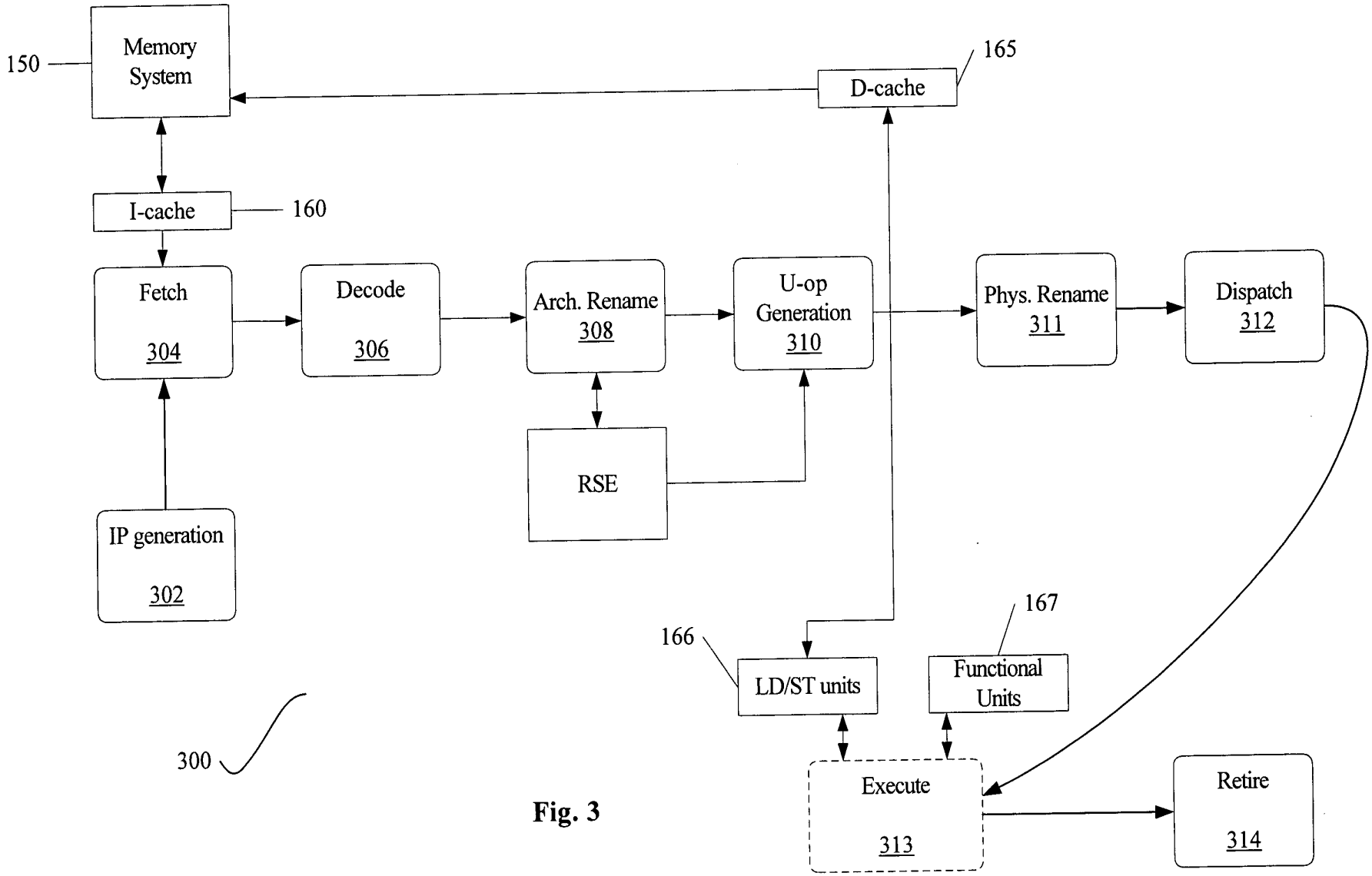

150
Memory System
165
D-cache
I-cache
160
Fetch
304
Decode
306
Arch. Rename
308
U-op Generation
310
Phys. Rename
311
Dispatch
312
RSE
IP generation
302
166
LD/ST units
167
Functional Units
300
Execute
313
Retire
314

Fig. 3

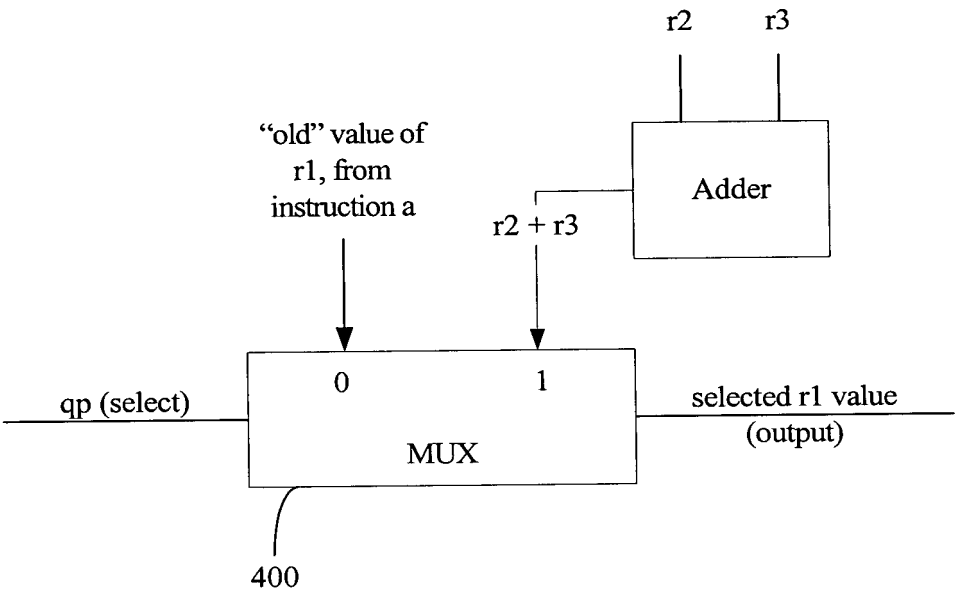

r2
r3
"old" value of
r1, from
instruction a
Adder
r2 + r3
0
1
qp (select)
selected r1 value
(output)
MUX
400

Fig. 4

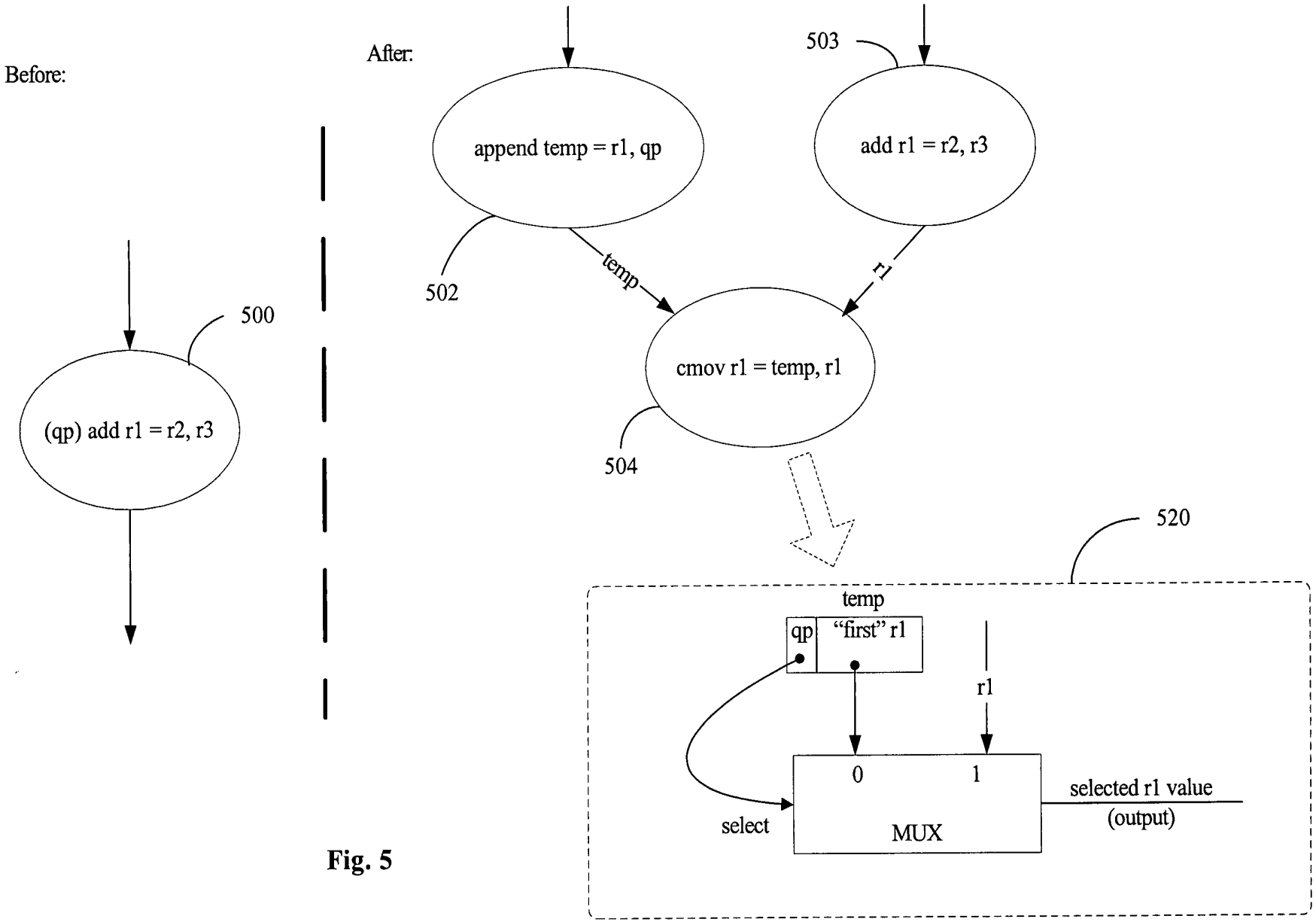

Before:
500
(qp) add r1 = r2, r3
After:
append temp = r1, qp
502
503
add r1 = r2, r3
temp
r1
cmov r1 = temp, r1
504
520
temp
qp
"first" r1
r1
0
1
select
MUX
selected r1 value
(output)

Fig. 5

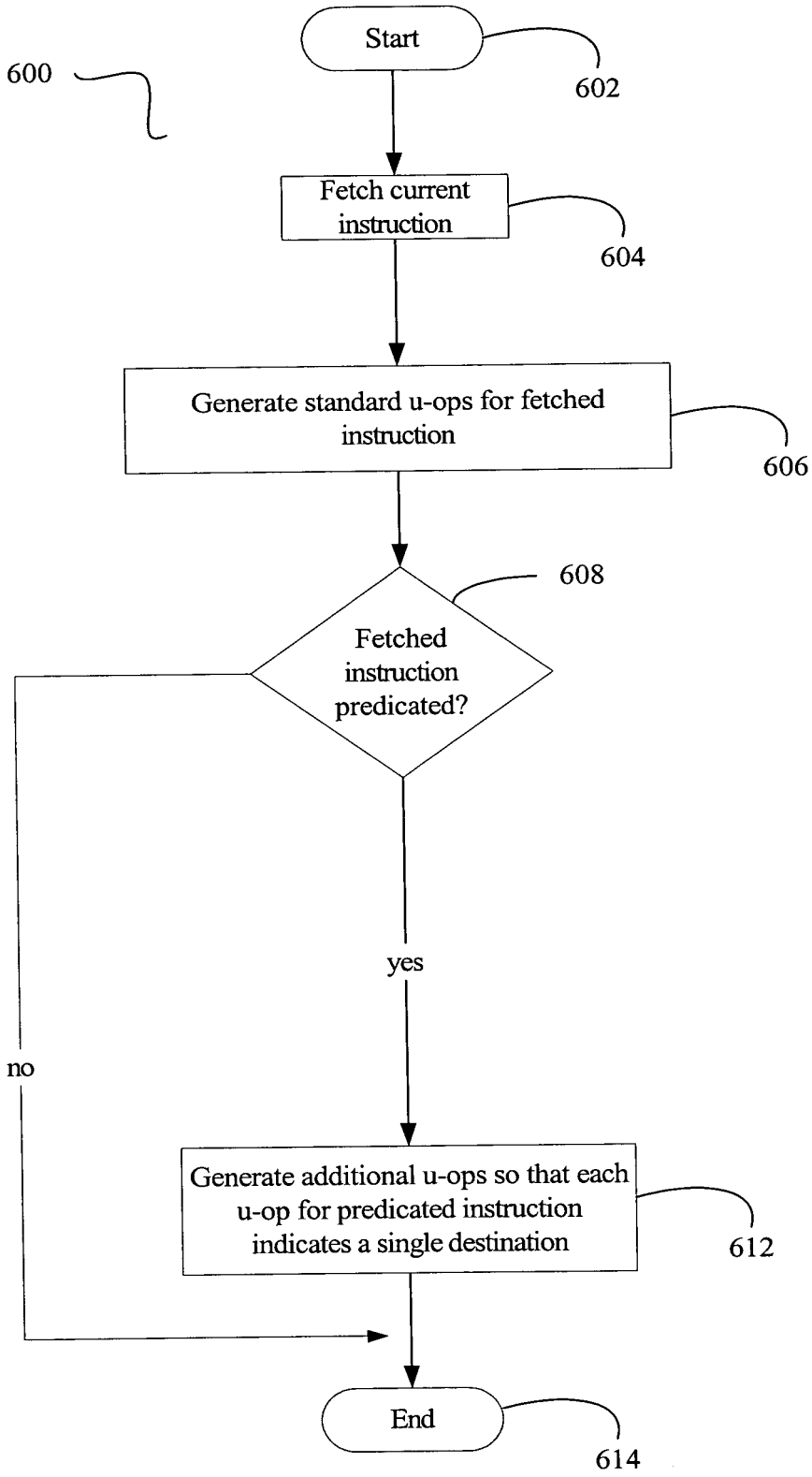

600
Start
602
Fetch current instruction
604
Generate standard u-ops for fetched instruction
606
608
Fetched instruction predicated?
yes
no
Generate additional u-ops so that each u-op for predicated instruction indicates a single destination
612
End
614

Fig. 6

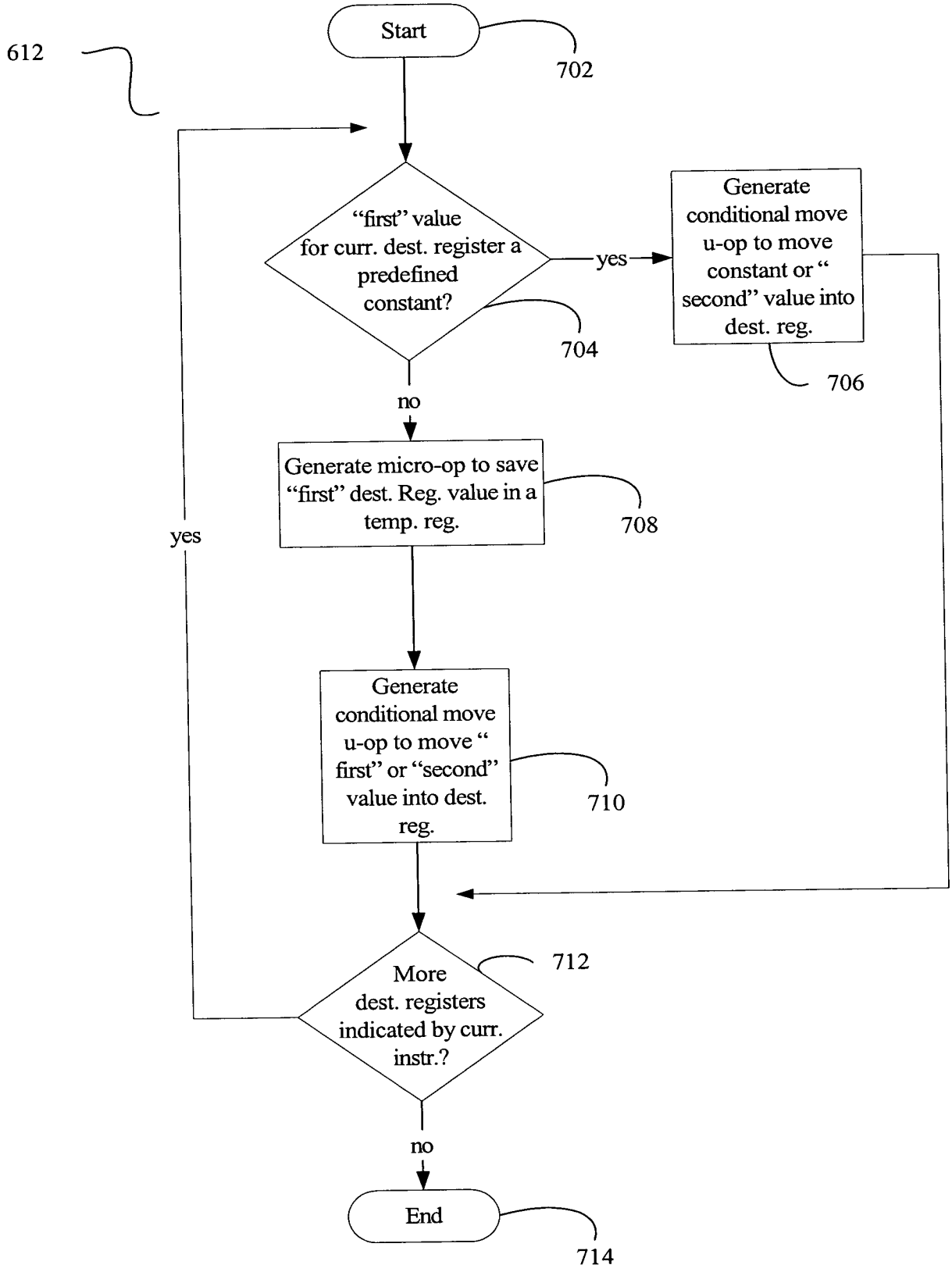

612
Start
702
"first" value for curr. dest. register a predefined constant?
704
yes
Generate conditional move u-op to move constant or " second" value into dest. reg.
706
no
Generate micro-op to save "first" dest. Reg. value in a temp. reg.
708
yes
Generate conditional move u-op to move " first" or "second" value into dest. reg.
710
More dest. registers indicated by curr. instr.?
712
no
End
714

Fig. 7

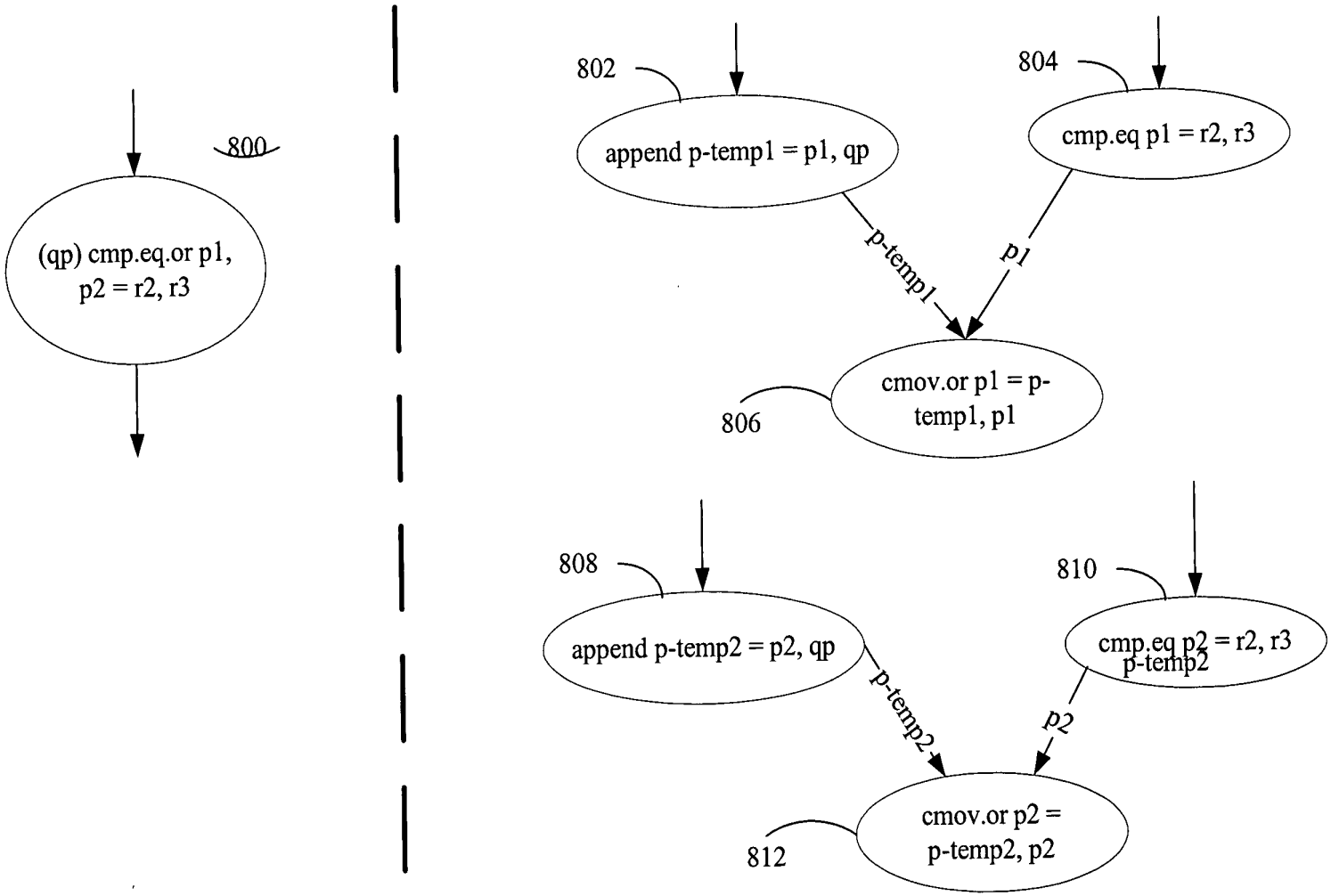
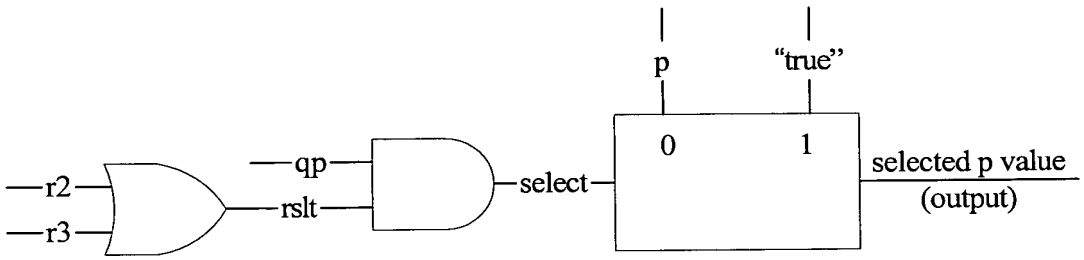

Before:
After:
800
(qp) cmp.eq.or p1, p2 = r2, r3
802
append p-temp1 = p1, qp
804
cmp.eq p1 = r2, r3
p-temp1
p1
806
cmov.or p1 = p-temp1, p1
808
append p-temp2 = p2, qp
810
cmp.eq p2 = r2, r3
p-temp2
p-temp2
p2
812
cmov.or p2 = p-temp2, p2

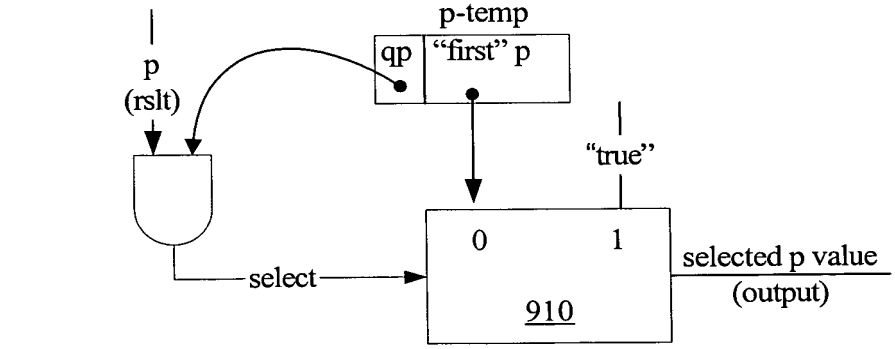
Fig. 8

Before:



902

After:



904

Fig. 9

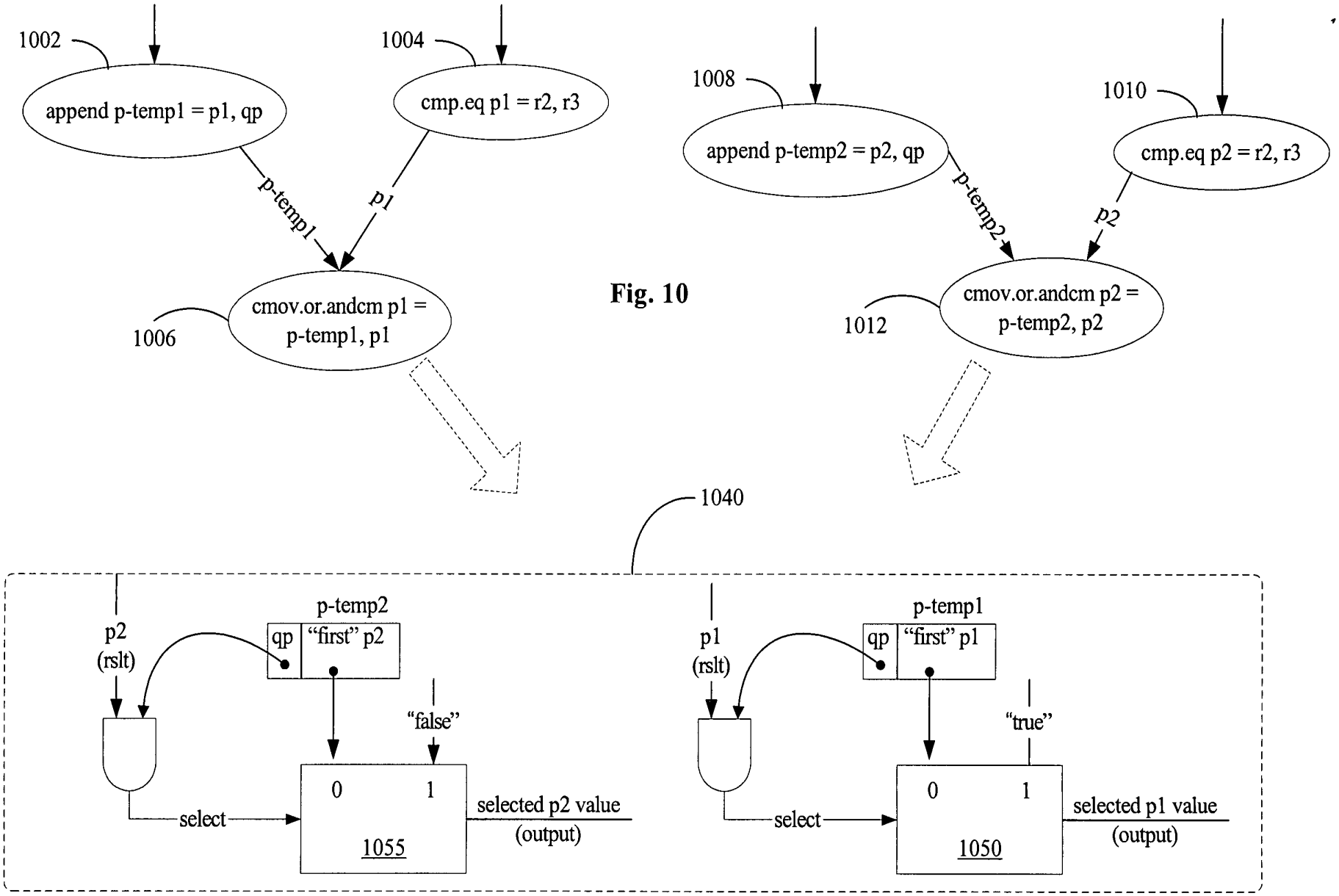

1002
append p-temp1 = p1, qp
1004
cmp.eq p1 = r2, r3
p-temp1
p1
1006
cmov.or.andcm p1 =
p-temp1, p1
1008
append p-temp2 = p2, qp
1010
cmp.eq p2 = r2, r3
p-temp2
p2
1012
cmov.or.andcm p2 =
p-temp2, p2
1040
p2
(rslt)
p-temp2
qp
"first" p2
"false"
0
1
select
1055
selected p2 value
(output)
p1
(rslt)
p-temp1
qp
"first" p1
"true"
0
1
select
1050
selected p1 value
(output)

Fig. 10

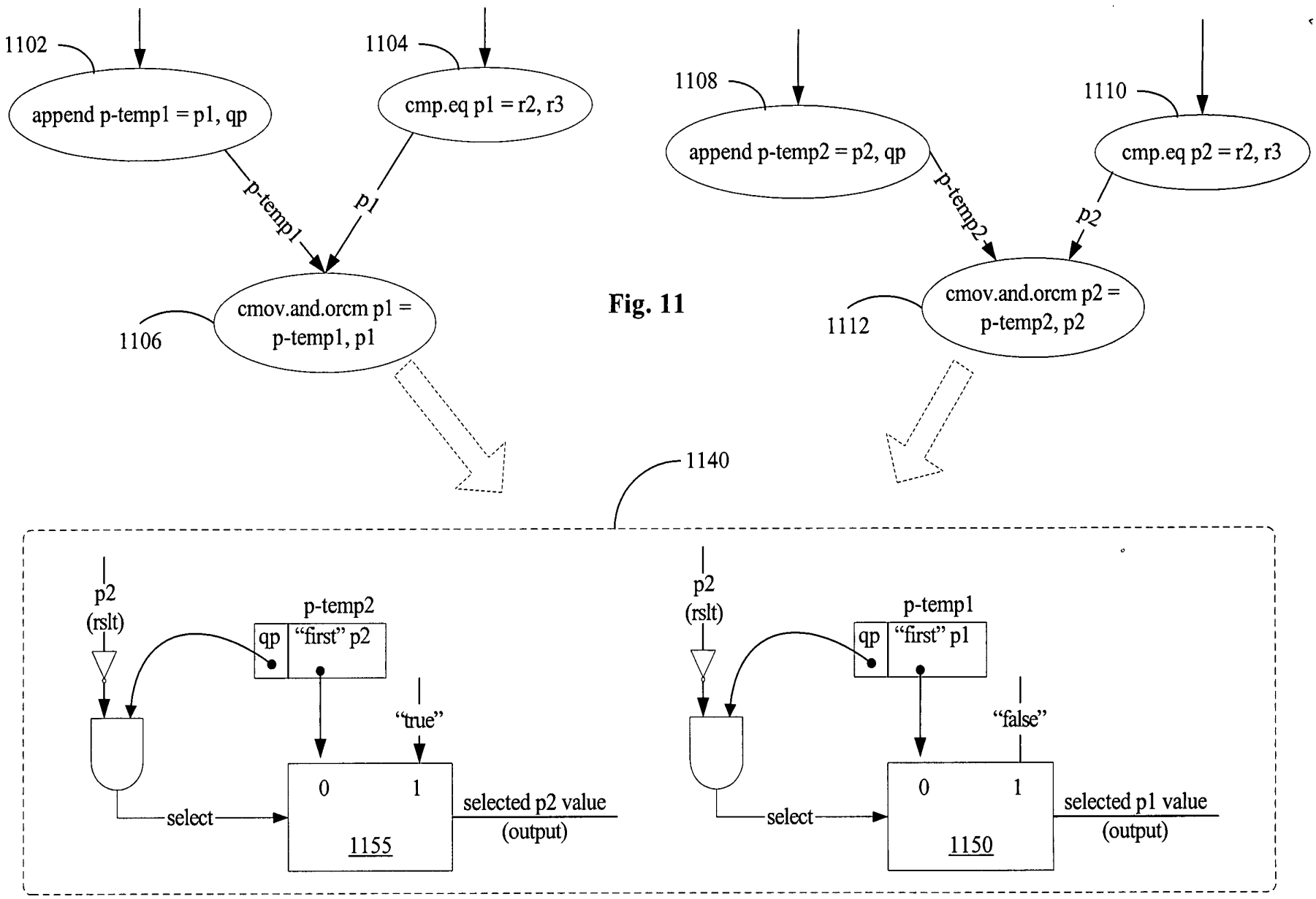

1102
append p-temp1 = p1, qp
1104
cmp.eq p1 = r2, r3
p-temp1
p1
1106
cmov.and.orcm p1 =
p-temp1, p1
1108
append p-temp2 = p2, qp
1110
cmp.eq p2 = r2, r3
p-temp2
p2
1112
cmov.and.orcm p2 =
p-temp2, p2
1140
p2
(rslt)
p-temp2
qp
"first" p2
"true"
0
1
select
selected p2 value
(output)
1155
p2
(rslt)
p-temp1
qp
"first" p1
"false"
0
1
select
selected p1 value
(output)
1150

Fig. 11